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(56) Documents cited

GB 1015975 A EP 0120149 A EP 0021805 A
US 4431083 A US 4415302 A

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(54) Forklift truck

(57) An improved forklift truck (1) having a U-shaped chassis (2) mounted on drivable front wheel (3) and a rear wheel (4) which is both steerable and drivable. Drive means for the wheels (3, 4) is hydraulic, a pump supplying hydraulic fluid to a motor at each wheel (3, 4). A fluid supply divider is operable to allow a three way split of hydraulic fluid to the wheels (3, 4) to ensure fluid supply to each wheel (3, 4) under slippery conditions. A telescopic mast (6) carrying lifting tines (10) is mounted on the chassis (2) between the front wheels (3) on a movable carriage (7). The carriage (7) is slidable on the chassis (2) by rams (15) between a forward extended position and a retracted position behind the front wheels (3). The mast (6) can be tilted and also moved laterally on the carriage (7) by rams (16, 60). The invention also provides mounting means for mounting the forklift truck (1) at a rear end of a lorry trailer chassis in a nested piggyback fashion.

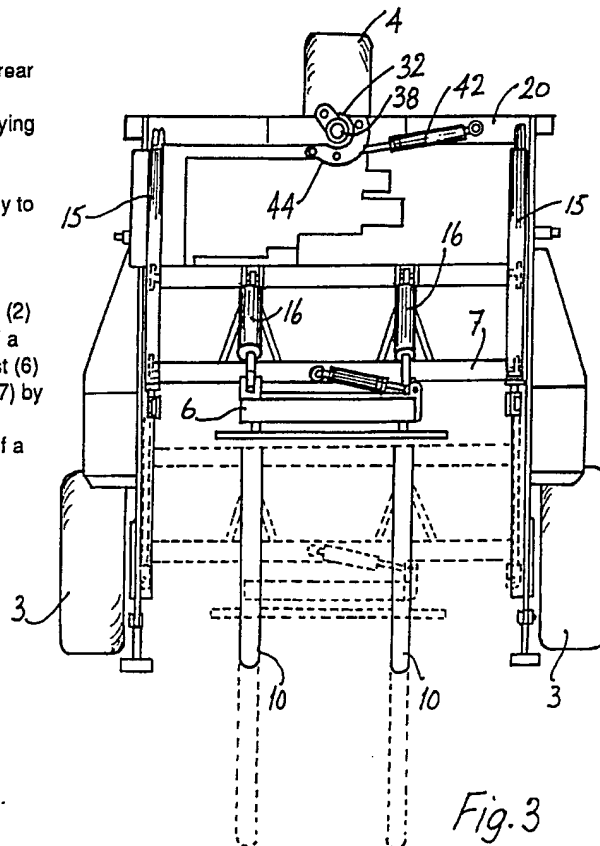
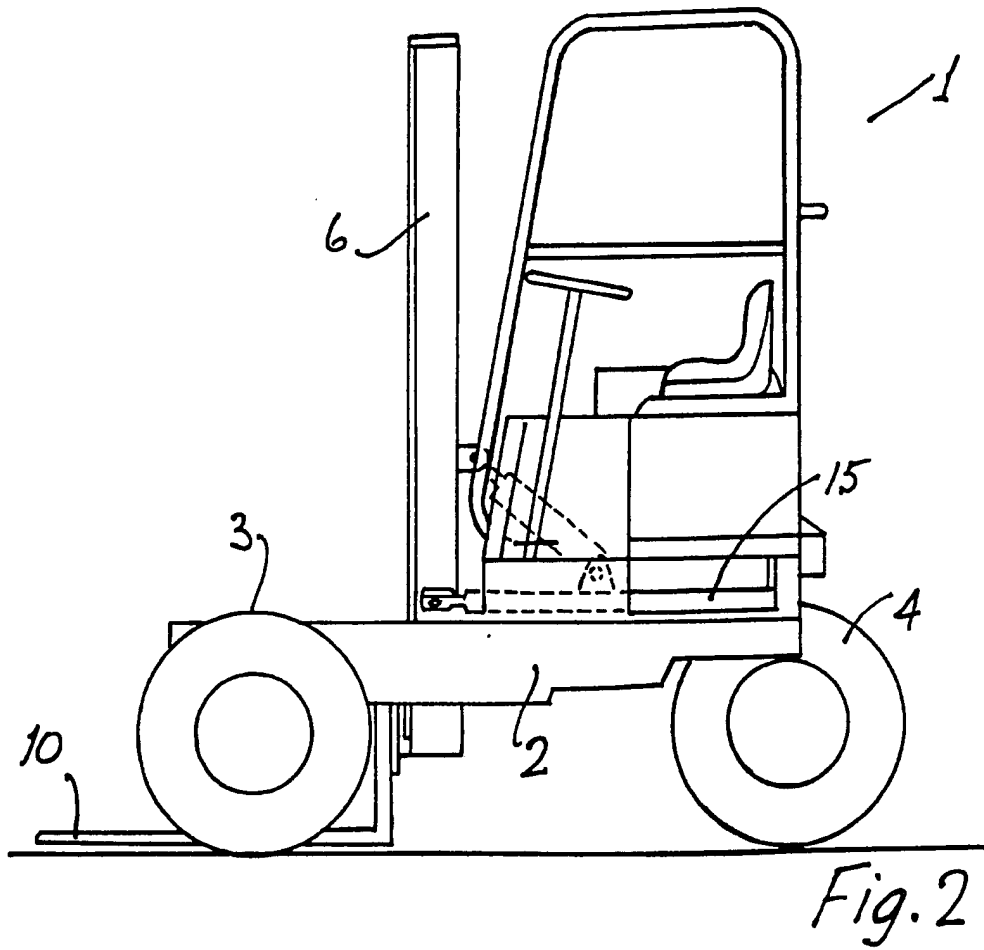
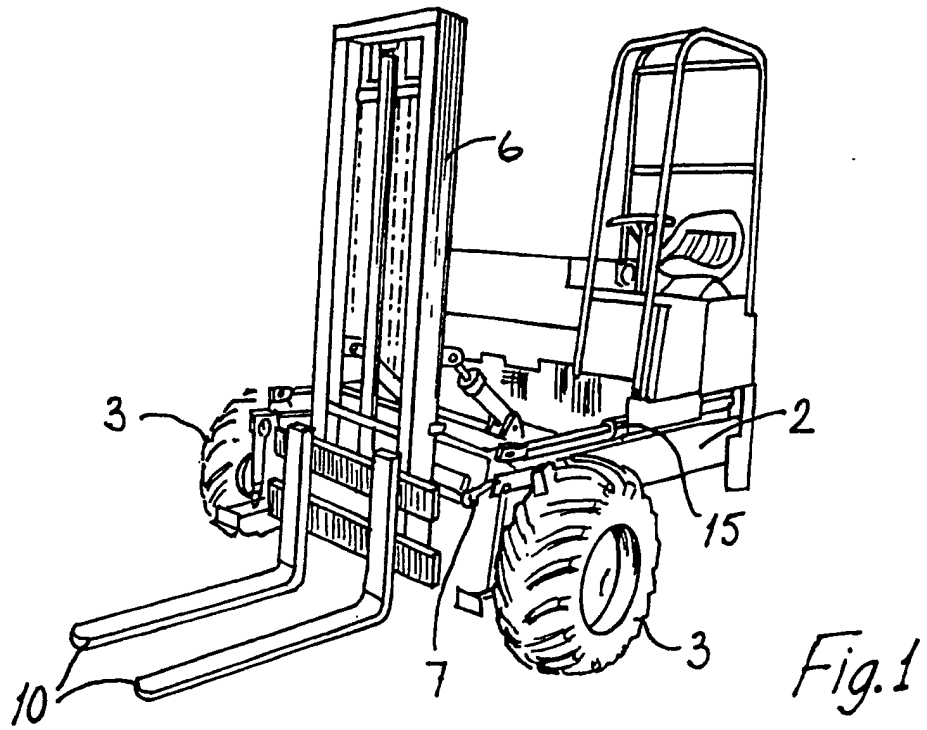


Fig. 3

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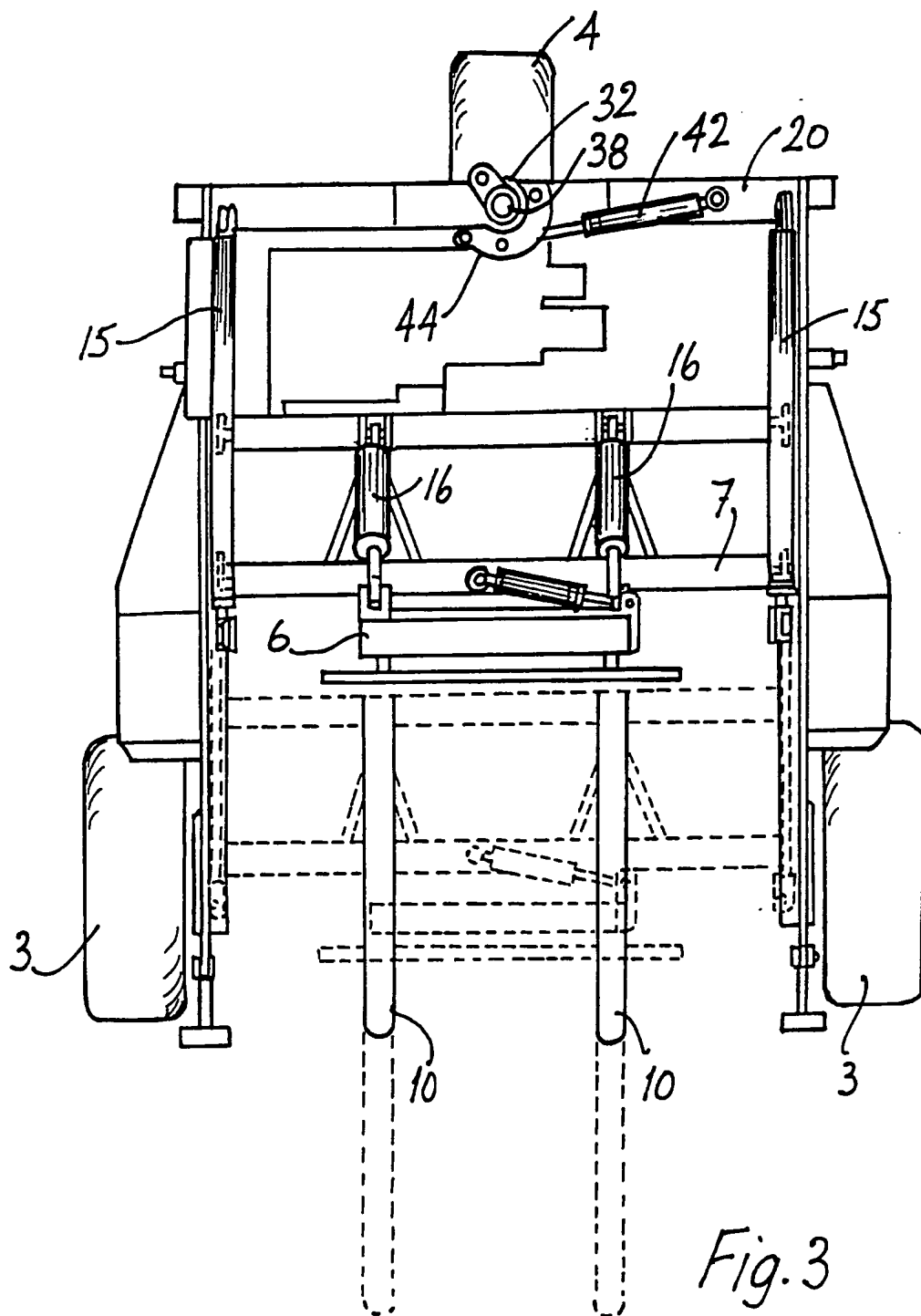


Fig. 3

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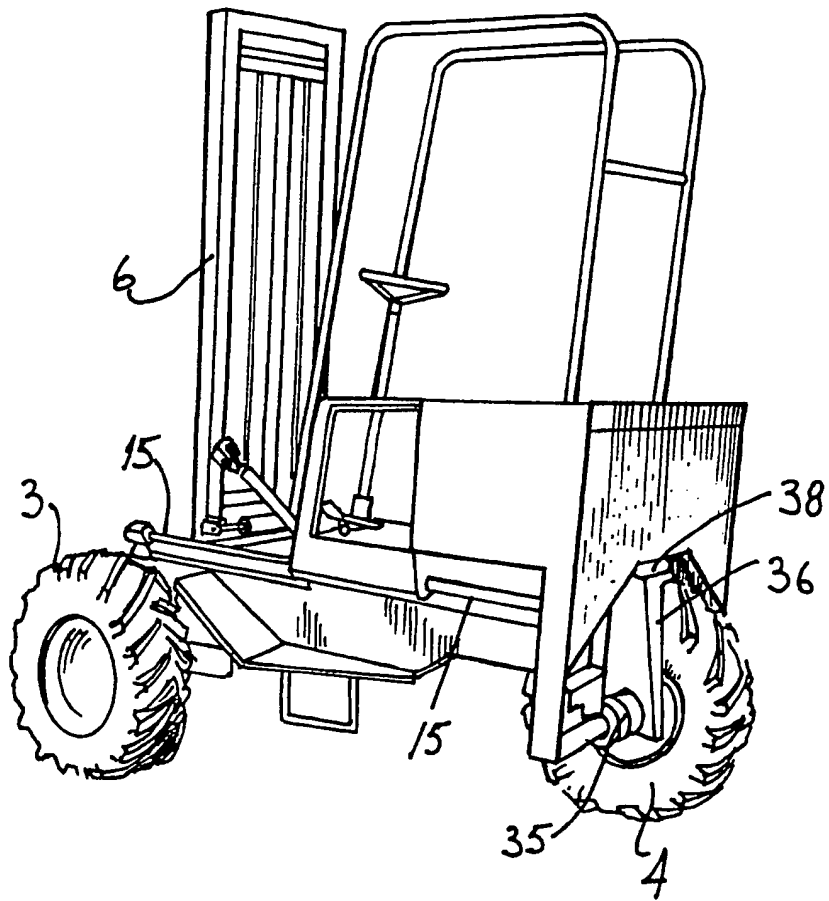
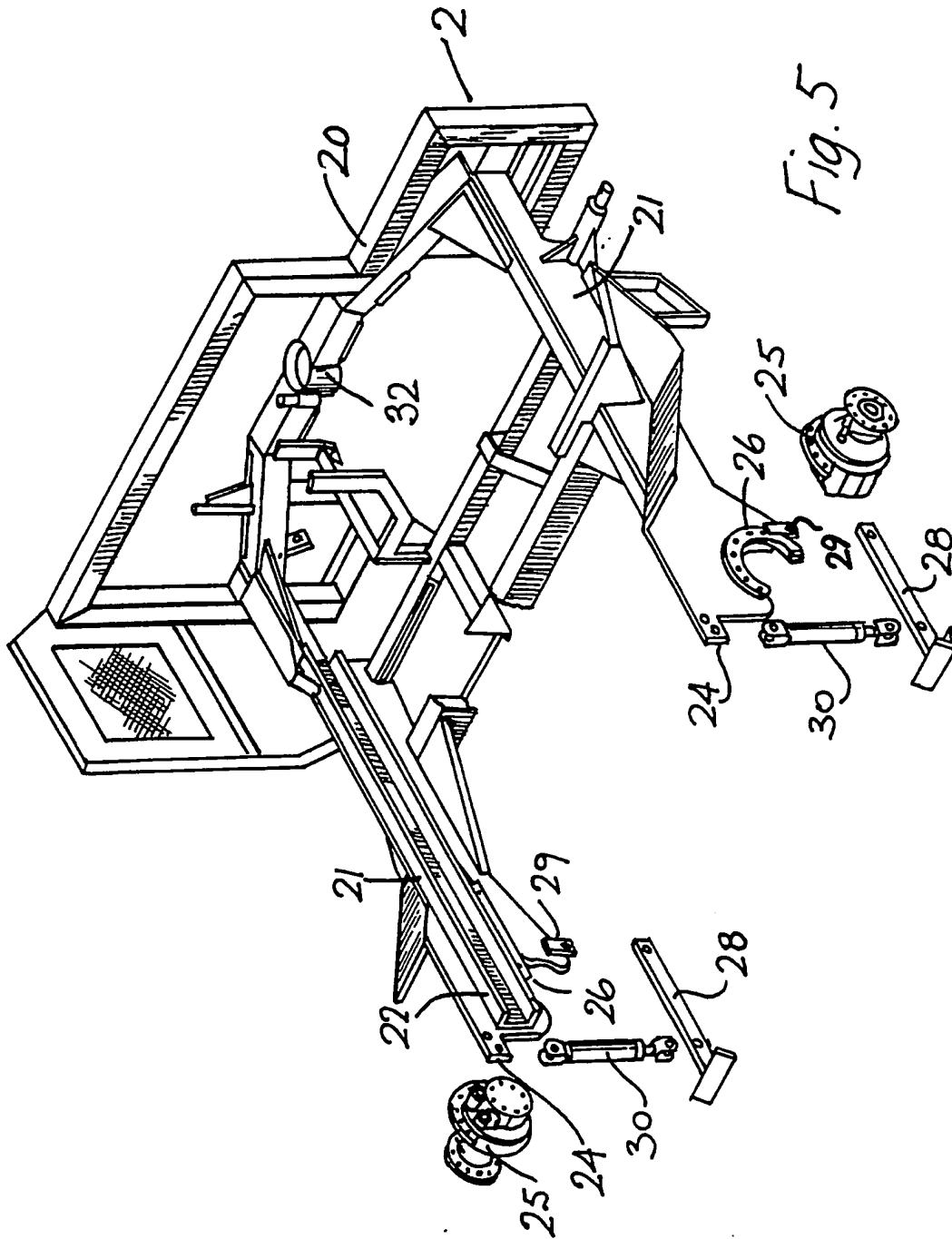


Fig.4



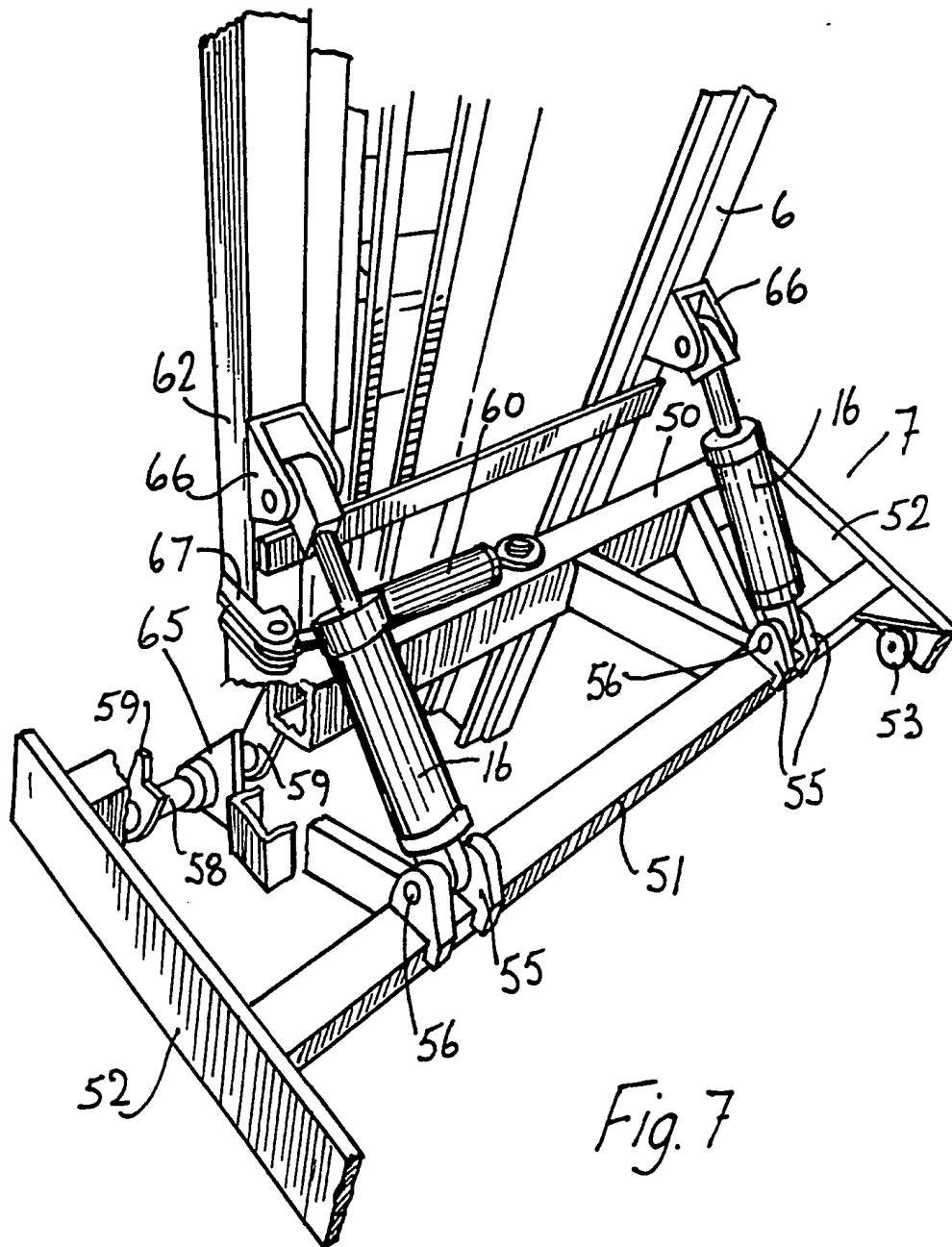


Fig. 7

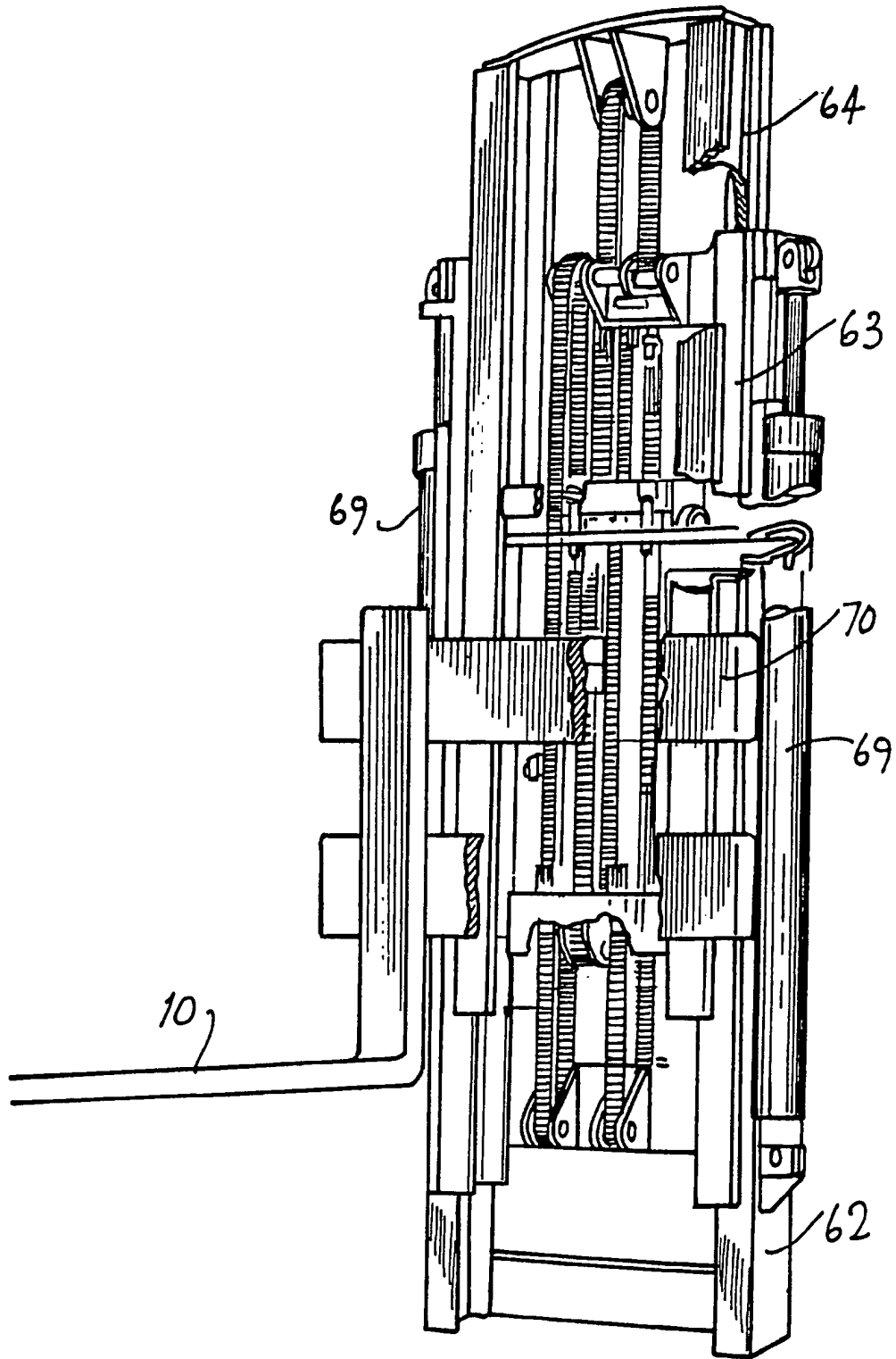


Fig. 8

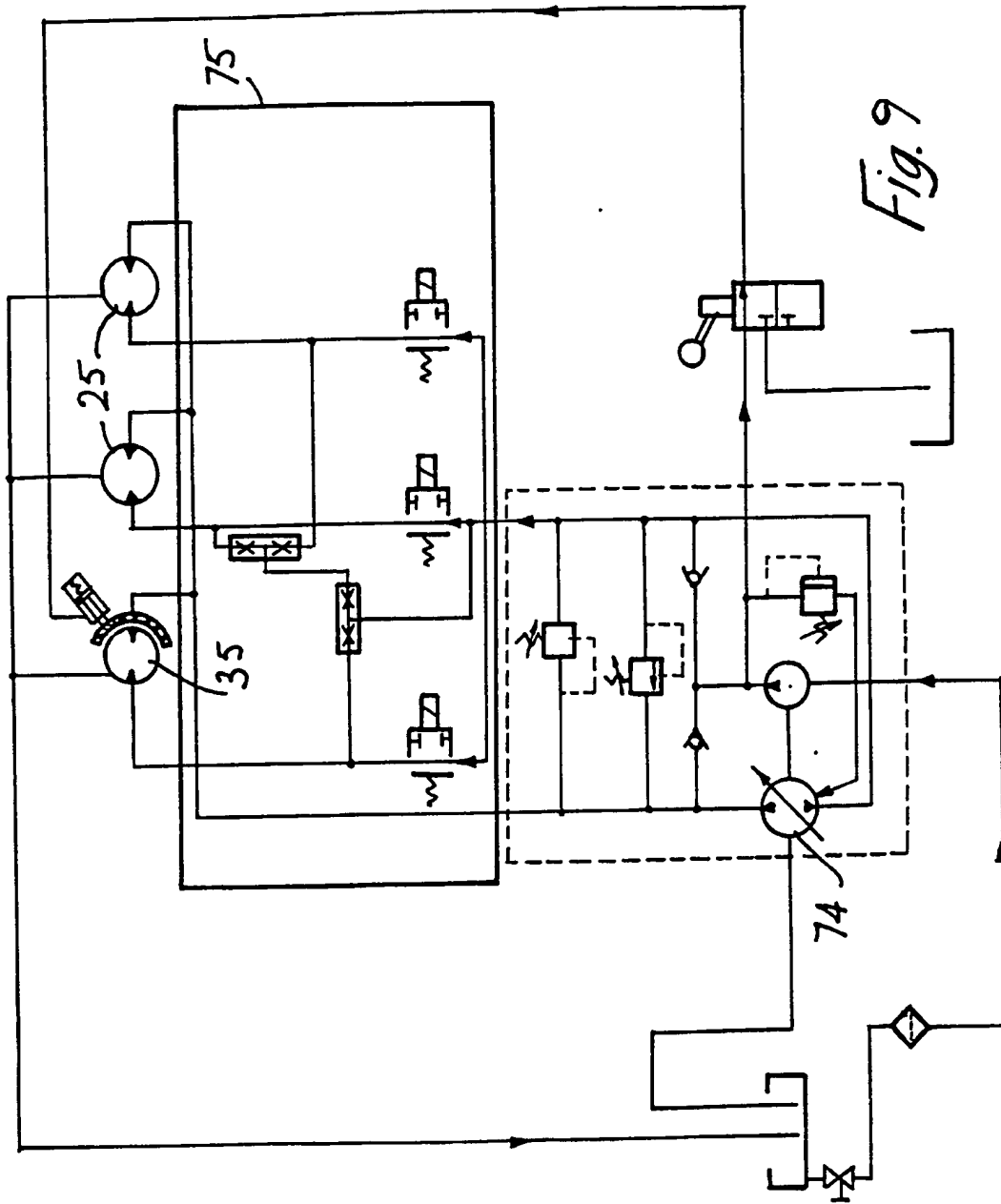


Fig. 9

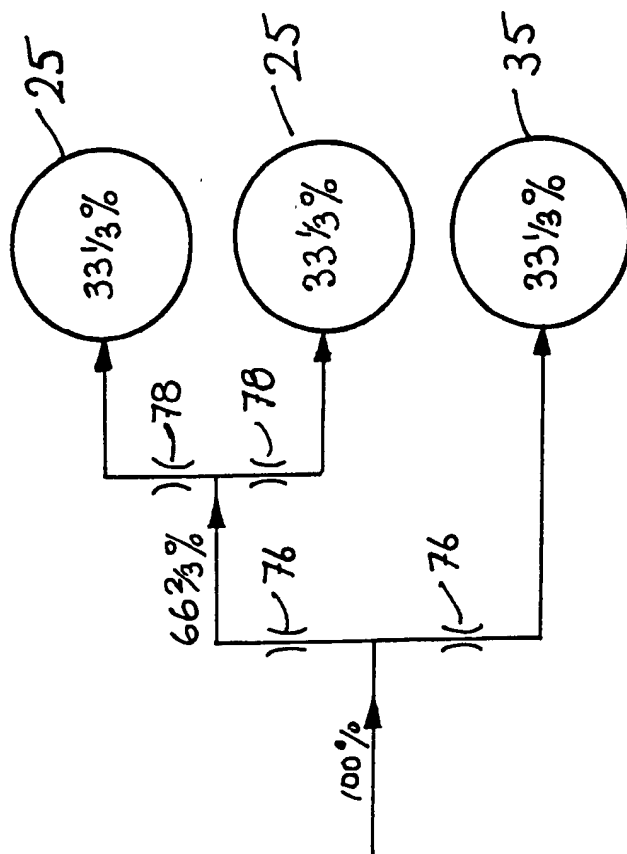


Fig. 11

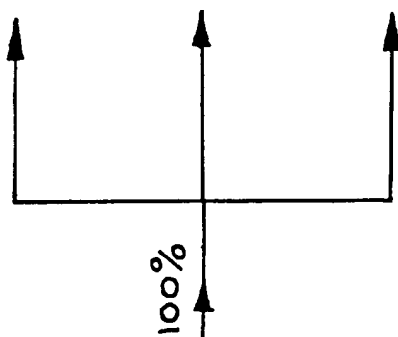
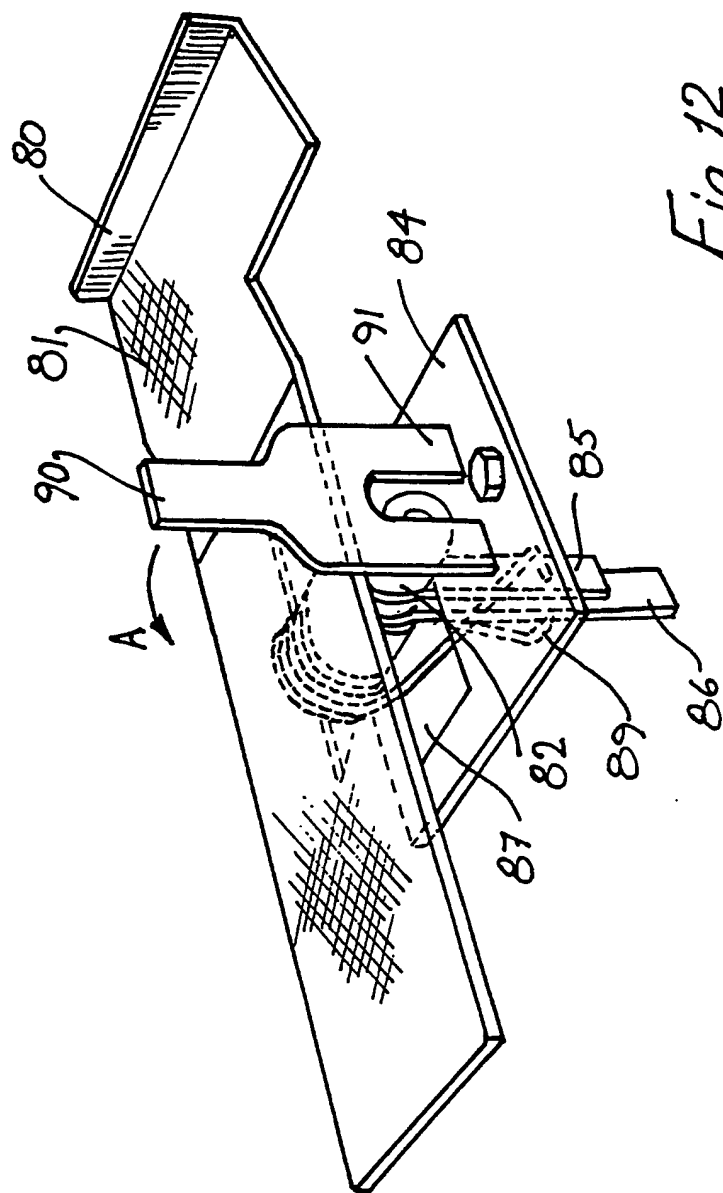


Fig. 10



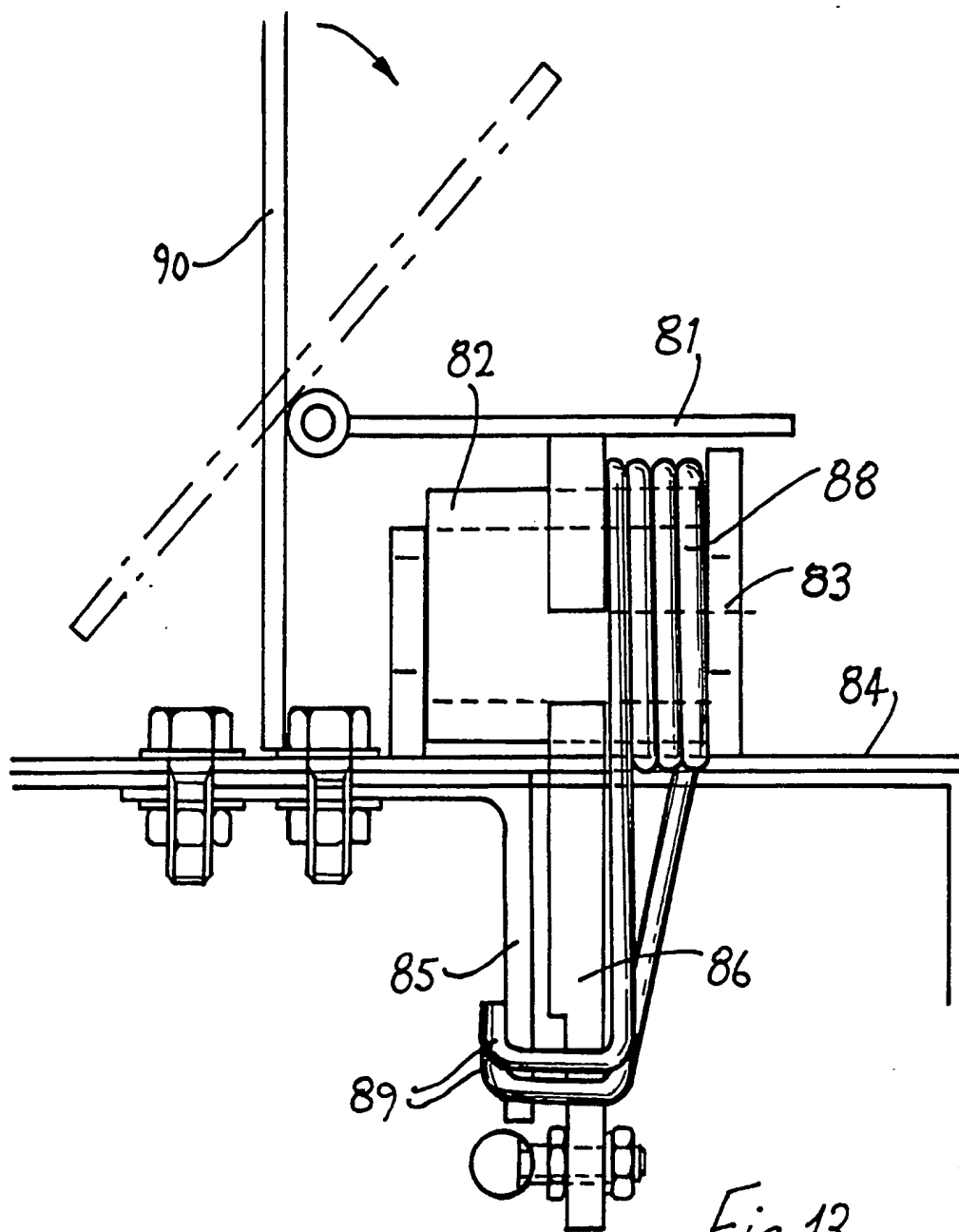


Fig. 13

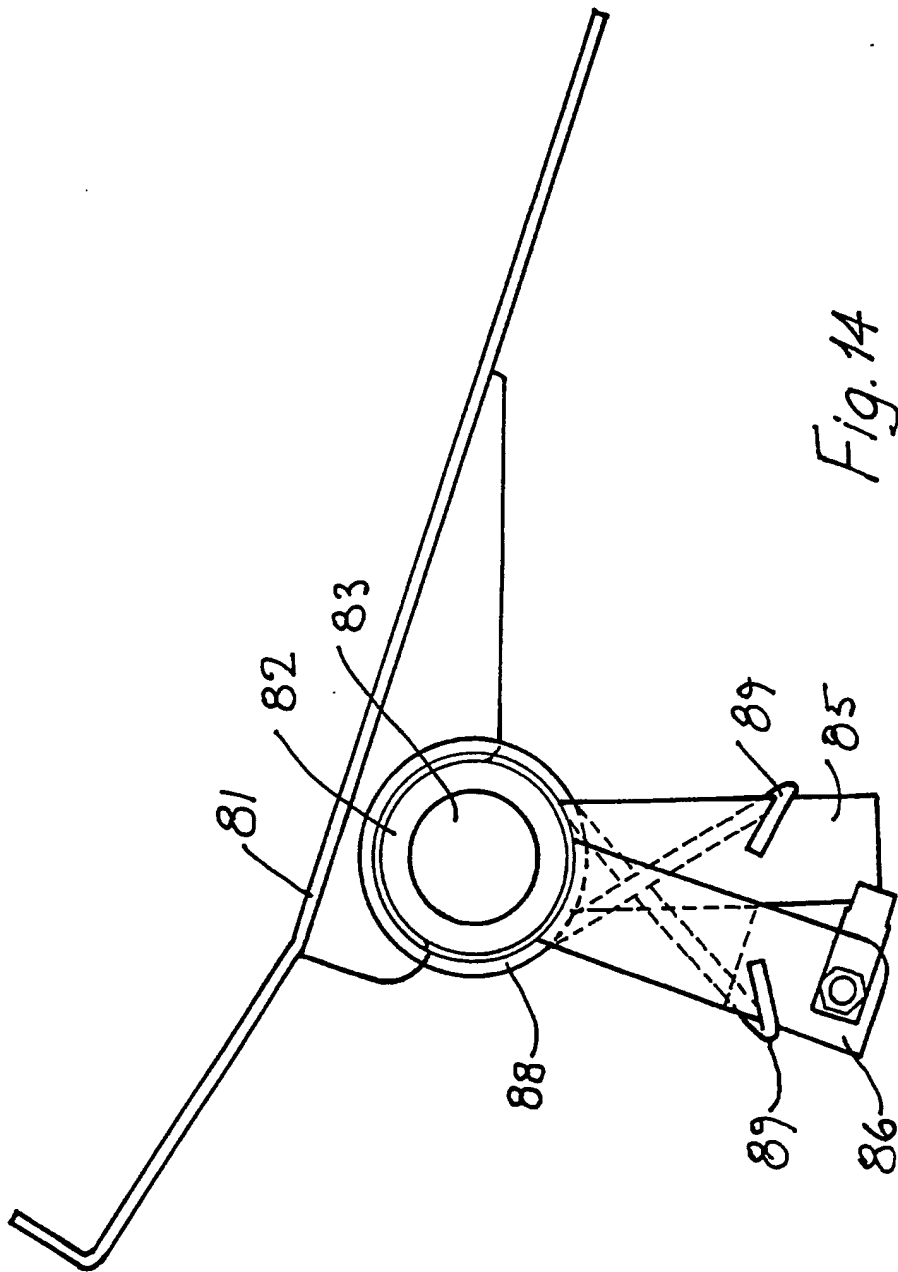


Fig. 14

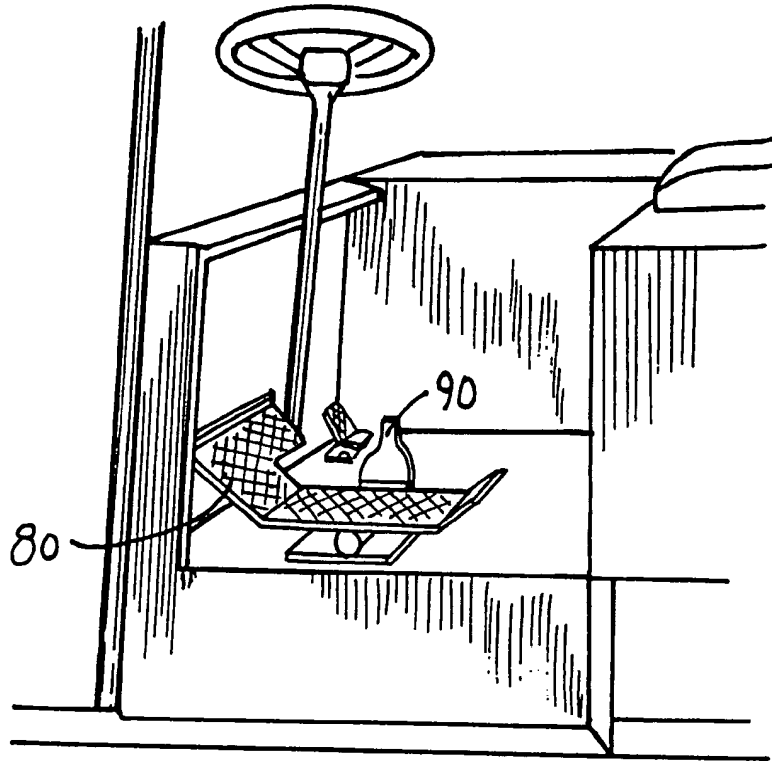


Fig. 15

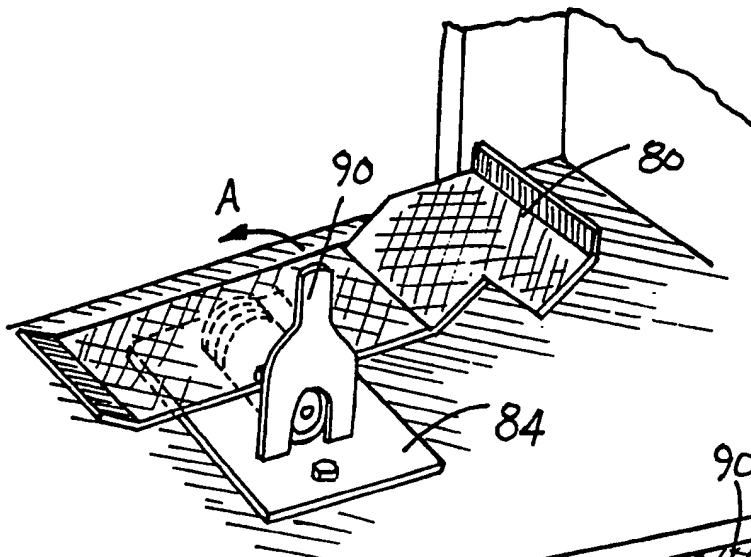


Fig. 16

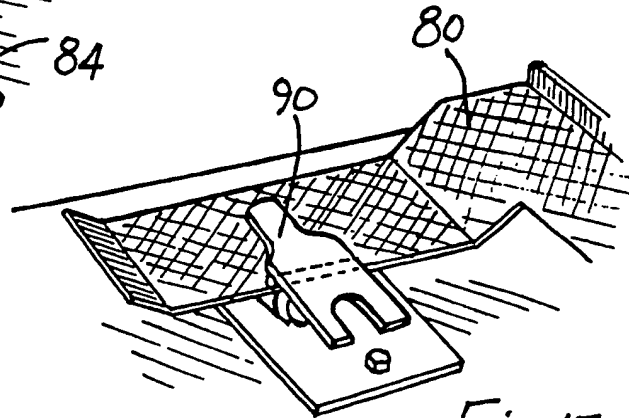
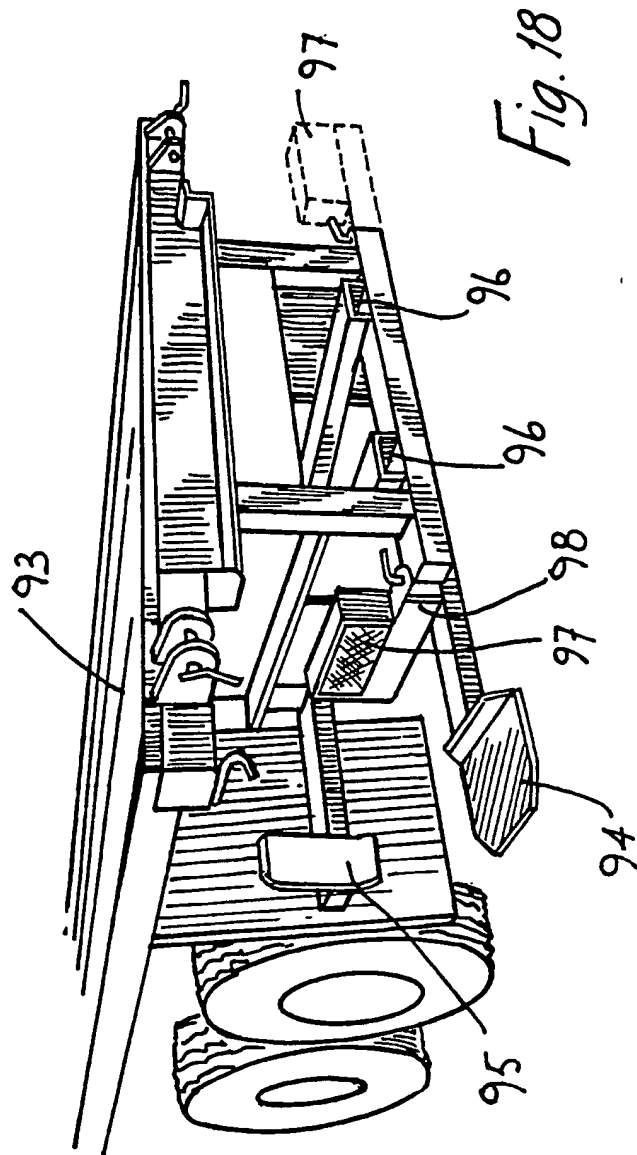
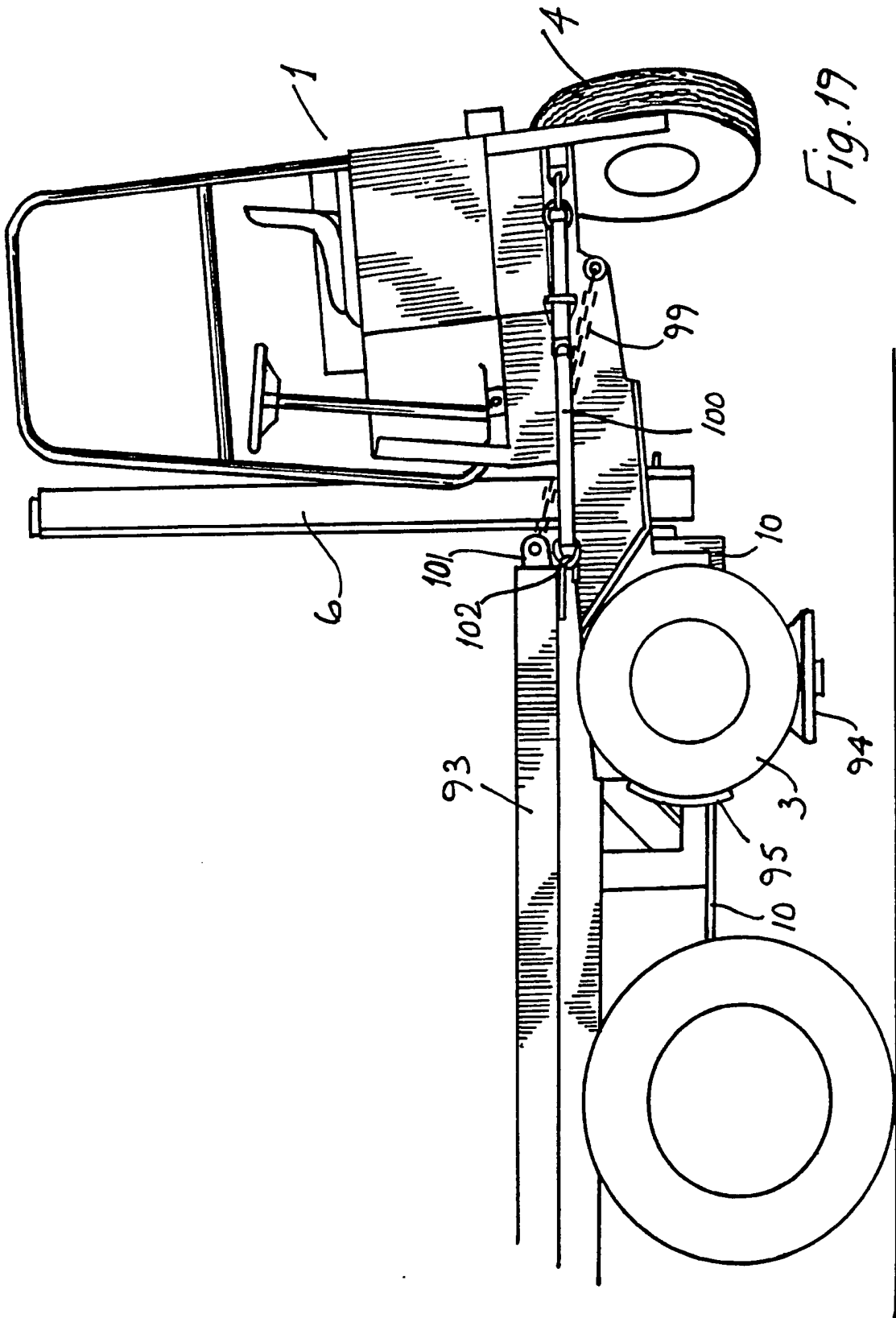


Fig. 17





"Improvements in and relating to forklift trucks"

This invention relates to forklift trucks, and in particular forklift trucks of the type that can be carried in piggy-back fashion at the rear end of a lorry chassis.

According to the invention there is provided a forklift truck
5 comprising a wheeled chassis having a pair of spaced-apart front wheels and a pivotable rear wheel with an associated steering mechanism, drive means on the chassis for driving at least one wheel, an upright mast mounted on the chassis between the two front wheels, lifting means mounted on the
10 mast and drivable vertically on the mast between a raised position and a lowered position, the mast being mounted on the chassis by a support carriage movable on the chassis between the front wheels and perpendicular to the axis of the front wheels and the mast being pivotally mounted on the carriage
15 for tilting movement about a transverse axis of the vehicle.

In one embodiment of the invention, the mast is a multi-stage mast having a number of telescopically interconnected mast portions.

In another embodiment the lifting means is independently
20 moveable on its associated mast portion.

In a further embodiment the mast is laterally moveable on the carriage.

In another embodiment means is provided for rotatably mounting the lifting means of the mast for rotation about a longitudinal axis of the truck.

In a particularly preferred embodiment all the wheels are drivable. Preferably, the drive means comprises a hydraulic motor mounted at each wheel, a pump to supply hydraulic fluid to the motors, and fluid supply divider means operable to regulate the supply of fluid to each wheel. Ideally, the divider means is operable to deliver one third of the fluid supply from the pump to each wheel.

In another embodiment the rear wheel is mounted by a vertical pivot shaft on the chassis and the steering mechanism comprises a ram extending between the chassis and a steering arm on the pivot shaft, the ram operably connected to a steering wheel on the chassis.

Preferably a driver's seat is provided on a chassis offset to one side of the chassis and surrounded by a safety frame.

In another embodiment stabiliser arms are pivotally mounted on the chassis adjacent each front wheel for movement between a ground engaging position and a raised stored position.

In another aspect the invention provides mounting means for securing the forklift truck on a lorry trailer chassis, the mounting means comprising wheel mounting brackets for attachment to the chassis for reception of the front wheels of the forklift truck, fork receivers for attachment to the chassis for reception of the forks of the truck and locking straps for engagement between the forklift truck and the trailer chassis to secure the forklift truck on the chassis with the front wheels of the forklift truck resting on the wheel mounting brackets.

The invention will be more clearly understood from the following description of an embodiment thereof, given by way of example only, with reference to the accompanying drawings, in which;

Fig. 1 is a front perspective view of a forklift truck according to the invention,

Fig. 2 is a side elevational view of the forklift truck,

Fig. 3 is a plan view of the forklift truck,

Fig. 4 is a rear perspective view of the forklift truck,

- Fig. 5 is an exploded view showing a chassis of the forklift truck,
- Fig. 6 is an exploded perspective view of a mast support carriage forming portion of the truck,
- 5 Fig. 7 is a detail perspective partially cut-away view showing the attachment of a mast to the carriage,
- Fig. 8 is a perspective partially cut-away view of a mast assembly of the truck,
- 10 Fig. 9 is a schematic illustration of a hydraulic drive circuit for wheels of the forklift truck,
- Figs. 10 are schematic illustrations of operation of
an 11 the drive circuit,
- 15 Fig. 12 is a perspective view of a forward/reverse drive control pedal assembly used in the forklift truck,
- Fig. 13 is a front elevational view of the drive pedal,
- Fig. 14 is a side elevation of the drive pedal,

Fig. 15 is a detail view of a driving position on the forklift truck showing the mounting of the drive pedal on the forklift truck,

5 Figs. 16 and 17 are detail views of the drive pedal mounted on the forklift truck,

Fig. 18 is a perspective view of a rear end of a lorry trailer chassis incorporating mounting means for mounting the forklift truck on the end of the trailer chassis, and

10

Fig. 19 is a side elevational view of the truck mounted at a rear end of the lorry trailer chassis.

Referring to the drawings, an initially to Figs. 1 to 8 thereof, there is illustrated a forklift truck according to the invention indicated generally by the reference numeral 1.

15 The truck 1 has a generally U-shaped chassis 2 mounted on a pair of drivable front wheels 3 and a rear wheel 4 which is both steerable and drivable. A telescopic mast 6 is mounted on the chassis 2 between the front wheels 3 by means of a support carriage 7. A pair of lifting tines 10 are mounted on

20 the mast 6 and are drivable vertically on the mast 6 between a raised position and a lowered position shown in Fig. 1.

The support carriage 7 is slidably movable on the chassis 2 by means of rams 15 at each side of the chassis 2 between a forward extended position as shown in Fig. 1 and a retracted position as shown in Fig. 2. The mast 6 is pivotal on the carriage 7 by means of rams 16 extending between the mast 6 and carriage 7.

Referring now in particular to Fig. 5, the chassis 2 is generally of U-shape having a rear cross member 20 and forwardly extending arms 21. Channel section carriage guides 22 extend along an inner face of each arm 21. Each guide 22 is a one piece cold rolled channel for simple construction and good strength and wear resistance. At a front end 24 of each arm 21 hydraulic drive motors 25 for each front wheel 3 are bolted in complementary arcuate sockets 26. Stabiliser arms 28 are pivotally mounted at 29 on the front end 24 of each arm 21. A ram 30 extends between the front end 24 and the stabiliser arm 28 to pivotally raise and lower the stabiliser arm 28.

A tubular bearing housing 32 is centrally located on the rear cross member 20. The rear wheel 4 has a hydraulic drive motor 35 mounted on a steering arm 36 which is pivotally mounted by a pivot shaft 38 which engages bearings located in the bearing housing 32. A steering ram 42 (see Fig. 3) extends between the cross member 20 and a steering link arm assembly 44

connected to the pivot shaft 38, the ram 42 being operable to rotate the steering arm 36 and thus the rear wheel 4.

Referring now in particular to Figs. 6 and 7 the carriage 7 is I-shaped having a pair of cross members, namely a front cross member 50 and a rear cross member 51 extending between side members 52. Roller bearings 53 mounted on each side member 52 engage within the carriage guides 22 on the chassis 2. Mast tilt ram mounting brackets 55 are provided on the rear cross member 51, the tilt rams 16 being mounted on the brackets 55 by pivot pins 56. On the front member 50 mast mounting pins 58 are each supported in a pair of spaced-apart brackets 59. It will be noted that the pins 58 are elongate to allow lateral movement of the mast 6 on the carriage 7. A side shift ram 60 is mounted on the front cross member 50 and engages with the mast 6, the ram 60 being operable to slide the mast 6 laterally on the carriage 7.

Referring now in particular to Fig. 8, the mast 6 is shown in more detail. In this case, the mast 6 is in three telescopically connected sections, namely, an outer mast section 62, a middle mast section 63 and an inner mast section 64. The mast sections 62, 63, 64 are of channel section and slidably inter-engage by means of rollers in conventional fashion. Tubular mast supports 65 (Fig. 7) are mounted on a rear face of the outer mast section 62 and slidably engage the pins 58 on the carriage 7. Tilt ram mounting brackets 66

(Fig. 7) project rearwardly of the outer mast section 62 for engagement by the tilt rams 16. On one side of the outer mast section 62 a mounting bracket 67 (Fig. 7) for engagement by the side shift ram 60 is provided. Rams 69 extend between the
5 outer mast section 62 and the middle mast section 63 operable for relative movement of the mast sections 62, 63, 64. A conventional fork carriage 70 is mounted on the inner mast section 64 for carriage of the lifting tines 10.

Referring now in particular to Figs. 9 to 11 the hydraulic
10 drive for the wheels 3, 4 of the forklift truck is illustrated. An hydraulic pump 74 supplies hydraulic fluid through a fluid supply divider means 75 to the hydraulic motors 25, 35 on the front wheels 3 and rear wheel 4. The divider 75 is operable to connect fluid supply from the pump
15 74 directly to all three wheel motors 25, 35 as schematically illustrated in Fig. 10. Alternatively, the divider 75 can be operated to deliver one third of the fluid supply from the pump 74 to each wheel motor 25, 35 as schematically illustrated in Fig. 11. Primary flow dividers 76 split the
20 fluid supply 77 from the pump in the ratio 1:2, one third of the fluid being delivered directly to the rear wheel drive motor 35. Secondary dividers 78 split the other fluid supply stream (containing two thirds of the supply from the pump 74) in half delivering one third of the original supply from the
25 pump 74 to each of the front wheel drive motors 25. In use, when the divider is disengaged and the pump 74 freely supplies

all motors 25, 35, if one wheel 3, 4 loses traction then the fluid supply will tend to be directed towards that wheel 3, 4. To ensure positive drive to all wheels in these circumstances, the divider 75 is engaged ensuring a maximum of one third of the fluid supply can be directed to the slipping wheel 3, 4 and thus maintaining drive to the remaining wheels 3, 4.

Referring now in particular to Figs. 12 to 17 a forward/reverse drive pedal 80 is shown. The drive pedal 80 has a foot plate 81 attached to a collar 82 pivotally mounted on a pivot shaft 83. The pivot shaft 83 is supported on a mounting plate 84 having a downwardly depending arm 85. A radial arm 86 on the collar 82 extends downwardly through a slot 87 in the plate 84 alongside the arm 85. A torsion spring 88 is mounted on the collar 82 and has downwardly projecting ends 89 which cross and wrap around the arms 85, 86. Thus, the spring 88 establishes a neutral position for the pedal 80. To operate the forward/reverse drive the pedal is pivoted on the shaft 83, as shown in Fig. 14, and when released, the pedal 80 returns to the central neutral position. A safety lock is provided to prevent operation of the pedal 80. The safety lock comprises a locking plate 90 pivotally mounted at one side of the foot plate 81, a lower end 91 of the locking plate 90 abutting the support plate 84 in the engaged position shown in Figs. 12, 15 and 16. For operation of the pedal 80 the locking plate 90 must be pivoted in the direction of arrow A (Fig. 12) flat against the foot

plate 81. The hinge mounting of the locking plate 90 may incorporate a spring to urge the locking plate 90 into the engaged position. Alternatively, the locking plate 90 is weight biased into the engaged position by having a lower portion of the locking plate 90 of greater weight than the upwardly projecting portion of the locking plate 90 above the foot plate 81. Fig. 15 shows the drive pedal 80 mounted at a driving position on the forklift truck. It will be noted that the pedal 80 is mounted at the entry to the driving position and engagement of the locking plate 90 prevents inadvertent use of the drive pedal 90 when mounting or dismounting from the driving position.

Referring now to Figs. 18 and 19, the truck 1 is shown mounted at a rear end of a lorry trailer chassis 93. Mounting brackets for reception of the front wheels 3 of the forklift truck 1 comprise wheel support plates 94 on which the wheels 3 rest and forwardly of the plates 94 upright front wheel stops 95. A pair of channel section fork receivers 96 are mounted between the plates 94 on the chassis 93. It will be noted that rear indicating lamps 97 are pivotally mounted on a pivotable support 98 to pivot forwardly to accommodate the wheels 3 of the forklift truck 1. To mount the forklift truck 1 on the trailer chassis 93 the tines 10 of the truck 1 engage within the receivers 96 and are then lowered to raise the truck 1 off the ground. When raising the forklift truck 1 the mast 6 of the forklift truck 1 is in its forwardly extended

position. When raised the rams 15 are operated to retract the mast 6 moving the front wheels 3 forwardly to rest on the support plates 94 and abut the stops 95. In this position locking straps, in this case comprising chains 99 and straps 5 100, are fastened between the forklift truck 1 and connectors 101, 102 at a rear end of the trailer chassis 93. When fastened the tines 10 are raised relative to the mast 6 and the mast 6 tilted such that the weight of the forklift truck 1 is taken by the plates 94 and chains 99 and no load is 10 carried by the mast 6. Advantageously, thus during transit no shock loads are transferred to the mast assembly.

The invention is not limited to the embodiments hereinbefore described which may be varied in both construction and detail.

CLAIMS

1. A forklift truck comprising a wheeled chassis having a pair of front wheels and a pivotable rear wheel with an associated steering mechanism, drive means on the chassis for driving at least one wheel, an upright mast mounted on the chassis between the two front wheels, lifting means mounted on the mast and drivable vertically on the mast between a raised position and a lowered position, the mast being mounted on the chassis by a support carriage movable on the chassis between the front wheels perpendicular to the axis of the front wheels, and the mast pivotally mounted on the carriage for tilting movement about a transverse axis of the vehicle.
2. A forklift truck as claimed in claim 1 wherein the mast is a multi-stage mast having a number of telescopically interconnected mast portions.
3. A forklift truck as claimed in claim 1 or claim 2 wherein the lifting means is independently movable on its associated mast portion.
4. A forklift truck as claimed in any preceding claim wherein the mast is laterally movable on the carriage.

5. A forklift truck as claimed in any preceding claim wherein means is provided for rotatably mounting the lifting means on the mast for rotation about a longitudinal axis of the truck.
- 5 6. A forklift truck as claimed in any preceding claim wherein drive means is provided for each wheel.
7. A forklift truck as claimed in Claim 6 wherein the drive means comprises a hydraulic motor mounted at each wheel, a pump to supply hydraulic fluid to drive the motors, and
10 fluid supply divider means operable to regulate the supply of fluid to each wheel motor.
8. A forklift truck as claimed in Claim 7 wherein the divider means is operable to deliver one third of the fluid supply from the pump to each wheel.
- 15 9. A forklift truck as claimed in any preceding claim wherein all the wheels are the same size.
10. A forklift truck as claimed in any preceding claim wherein the rear wheel is mounted by a vertical pivot shaft on the chassis and the steering mechanism comprises
20 a ram extending between the chassis and a steering arm on the pivot shaft, the ram operably connected to a steering wheel on the chassis.

11. A forklift truck as claimed in any preceding claim wherein a driver's seat is provided offset to one side of the chassis and surrounded by a safety frame.
12. A forklift truck as claimed in any preceding claim wherein stabiliser arms are pivotally mounted on the chassis adjacent each front wheel for movement between a ground engaging position and a raised stored position.
13. Mounting means for securing the forklift truck as claimed in any preceding claim on a lorry trailer chassis, the mounting means comprising wheel mounting brackets for attachment to the chassis for reception of the front wheels of the forklift truck, fork receivers for attachment to the chassis for reception of the forks of the forklift truck and locking straps for engagement between the forklift truck and the trailer chassis to secure the forklift truck on the chassis with the front wheels of the forklift truck supported on the wheel mounting brackets.
14. A forklift truck substantially as hereinbefore described with reference to the accompanying drawings.

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Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

9127539.6

Relevant Technical fields

(i) UK CI (Edition K) B8H, HPD, B8L, LA, LB B7H, HA

(ii) Int CI (Edition 5) B66F 9/10, 14 AND 16

Search Examiner

D MCMUNN

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

10 APRIL 1992

Documents considered relevant following a search in respect of claims 1-12

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 1015975 (HAN STILE)	6
X, Y	EP 0120149 (BROUWER TURF)	1-5, 6
X, Y	EP 0021805 (BROUWER TURF)	1-5, 6
X	US 4431083 (CATERPILLAR)	1-3, 5
X	US 4415302 (BROUWER TURF)	1-5

Category	Identity of document and relevant passages	Relevant to claim(s).

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